Comments on Cost Estimation

(from a decidedly non-expert source)

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Cost Estimation Comments

- Mostly magnets – but also include related systems
- Time scale exceptionally short
  - ➡ Use existing designs/ cost information wherever possible
    - Tesla/XFEL cost estimates
      - If in usable forms
    - NLC estimates
      - Inflated for FY2006
    - Other recent magnet programs
      - E.g., LHC quads for 2 mrad line
  - ➡ Three main areas
    - ED&I (Engineering, Design, & Inspection)
      - Include magnet design, quality control, supervision
      - Testing cost go here (?)
    - Materials
      - Parts, expendables, etc.
    - Labor
      - Sorting, fabrication, handling

Cost Estimation Comments, cont.

- **We will not be able to make estimates for all regions, but**
  - **Separate cost into scalable units**
    - **Labor in hours**
      - **Hourly rates can be varied**
    - **Materials in unit quantities**
      - **Unit costs can be varied**
  - **In some cases, we will try to get independent estimates from different regions**
    - **Pick large quantity, conventional magnet(s)**
      - **e+ source xfer line quads**
      - **Damping ring dipoles**
    - **Main linac quadrupoles**
      - **High gradient version**
    - **Possible estimates from**
      - **Russia, Japan, China,…**
    - **Short time, limited response – probably labs & institutes**

Cost Estimation, cont.

- **We will combine magnets into 'styles' – e.g., dipoles within a certain aperture, physical length, field strength etc.**
  - **Approach used by C. Spencer and NLC colleagues for the NLC magnet cost estimates**
    - **Develop conceptual design and cost estimate for a specific 'style'**
    - **Develop scaling rules for calculating cost for specific instances of a given 'style'**
  - **Define a set of 'standard' components?**
    - **Cu conductor sizes**
    - **Iron core – solid or laminations?**
  - **Contract with (at least) one outside vendor for an independent cost estimate ?**
    - **Time scale?**
    - **Resources – funding available?**

Cost Estimation, cont.

- Specialty magnets -
  - Undulators, wigglers, kickers, etc.
    - Relatively small numbers
    - Cost estimates from existing designs
    - Effect on total cost estimate small...
      - Larger uncertainty
  - Superconducting magnets
    - 20 mrad IR – BNL design & cost estimate
    - 2 mrad IR - Fermilab LHC quad design & cost estimate
    - Main Linac
      - DESY/CIEMAT design
      - Fermilab & KEK designs

Cost Estimation, cont.

- Stands & movers
  - Movers
    - Cost estimates exist for SLAC design (2003?)
      - Additional R&D needed to reach needed accuracy
    - R&D effort on-going at Colorado State Univ (D. Warner)
      - Improved performance
      - David will be here tomorrow and can discuss status
  - Stands
    - Basic support structures not yet defined
    - Damping rings – integrated mechanical design of stands, vacuum system support, etc. underway at LBNL
    - Need an ME here

Cost Estimate, cont.

- Power supplies, cabling, etc.
  - Commercial products available for large fraction of magnets
  - Specifications & reliability need to be defined
    - Stability requirements
      - Noise & ripple specs
    - Reliability - redundancy
      - Magnets in string – seems obvious
      - Individually powered magnets
        - Double all supplies?
        - Determine impact if PS dies?
        - Replacement access?
        - Main supply + shunts/individual trims?
  - Power cables
    - Adopt SLAC "NEC+2" criterion to keep tunnel heat input to <10 w/m
  - Controls Interfaces
    - *tbd*

Cost Estimation, cont.

- What is missing?
  - Test and Measurement
    - Magnetic measurements and Alignment
      - At vendors
        - Provide equipment (?)
        - Cost, support, control
      - At ILC Laboratory
        - Facilities
        - Equipment
    - Cold Test
      - Facility needed at ILC Laboratory
        - Cryogenic plant shared with SRF & accelerator?
        - Cold test infrastructure
        - Equipment
  - Tunnel infrastructure
    - Cable trays, LCW, AC power, etc – coordinate with CF&F

Cost Estimation, cont.

❖ What is missing, cont.

- **Spares**
  - Not typically part of 'total project cost'; but,
  - Should be accounted for in procurements
    - Cost savings
    - 'Lifetime' (interest) of suppliers
  - Guidance from on high is needed
- **Installation**
  - Different group and budget?
    - Cost and resources for checkout and installation support
- **Commissioning**
  - Not part of 'total project cost' but some fraction or it occurs during installation…